PATENT ABSTRACTS OF JAPAN

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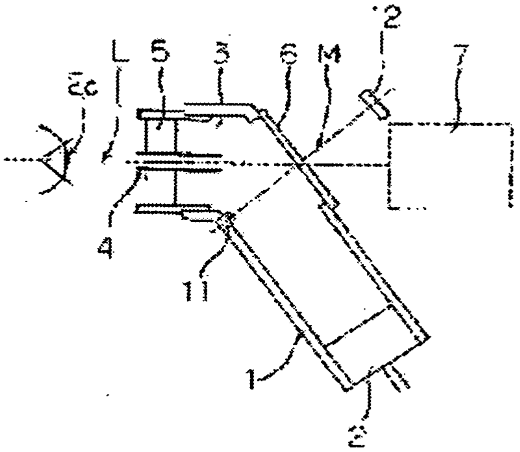
(54) CONTACTLESS OPHTHALMOTONOMETER

(57)Abstract:

PURPOSE: To provide a device capable of automatically detecting the stain of an optical element in the rear part of an air compressing chamber without giving the inspector trouble.
CONSTITUTION: This contactless type ophthalmotonometer is constituted to compress the gas in a cylinder 1 by a piston 2 and to blow the compressed gas from the compressing chamber 3 communicating with this cylinder through a nozzle 4 toward the eye to be examined. The ophthalmotonometer described above has the light transparent optical element disposed in the compressing chamber 3 to allow the transmission of the luminous flux advancing along the axial line of the nozzle 4 for the purpose of position adjustment, etc., and a light projecting means for projecting the luminous flux toward the optical element. Further, the meter has a light quantity detecting means for detecting the light quantity level of the luminous flux of the light projecting means transmitted through the optical element and a comparing means for comparing the light quantity level detected by this light quantity detecting means and a prescribed light quantity level. The stain of the optical element is thus detected.



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CLAIMS

[Claim(s)]

[Claim 1] In the non-contact type tonometer on which a compression gas is sprayed to optometry-ed through a nozzle from the compression space which compresses the gas in a cylinder with a piston and is open for free passage in said cylinder The optical element of the translucency prepared in said compression space in order to penetrate the flux of light for the justification which progresses along the direction of an axis of said nozzle, A floodlighting means to floodlight the flux of light towards this optical element, and a quantity of light detection means to detect the quantity of light level of the flux of light of said floodlighting means which penetrated said optical element, Non-contact type tonometer characterized by having a comparison means [predetermined quantity of light level / level / which was detected by this quantity of light detection means / quantity of light], and making the dirt of said optical element detectable.

[Claim 2] Either the floodlighting means of claim 1 or a quantity of light detection means is the non-contact type tonometer characterized by laying underground in the above-mentioned cylinder or compression space.

[Claim 3] Quantity of light detection of the quantity of light detection means of claim 1 is non-contact type tonometer characterized by carrying out whenever it sprays a compression gas to optometry-ed and a piston returns to a criteria location.

[Claim 4] The predetermined quantity of light level compared with the comparison means of claim 1 is the non-contact type tonometer of claim 1 characterized by to establish the warning means which emits warning when it is below the predetermined quantity of light level to which it was set based on the quantity of light required for measurement of the flux of lights, such as the justification flux of light which penetrates said optical element, and the quantity of light level further detected by said quantity of light detection means was set.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention sprays a compression gas on optometry-ed, deforms a cornea, and relates to the non-contact type tonometer which measures the intraocular pressure examined the eyes by detecting the deformation condition.
[0002]
[Description of the Prior Art] As a device which injects the compression gas of this kind of non-contact type tonometer, the device as shown in drawing 4 is known. The piston 2 in a cylinder 1 is pushed up upwards by the non-illustrated drive with measurement initiation. the hole with which the air compression room 3 which is open for free passage in a cylinder 1 holds a nozzle 4 — the side attachment wall is constituted by the posterior part aperture 6 grade which consists of aperture glass 5 and a transparence plate. The posterior part aperture 6 is on the axis L of a nozzle 4, the optical-system groups 7, such as observation optical system, justification optical system, fixation optical system, and a measuring beam study system, are arranged behind the posterior part aperture 6, and each of that flux of light passes the posterior part aperture 6. If measurement is started, a piston 2 moves to the location shown by the dotted line within a cylinder 1, and the air in a cylinder 1 will be compressed by this at the air compression room 3, and will be sprayed on the cornea Ec examined the eyes from a nozzle 4. As for a piston 2, from a nozzle 4, the air for the next measurement is inhaled by the initial valve position after air injection at return and this time.
[0003]
[Problem(s) to be Solved by the Invention] When a piston 2 returns to an initial valve position in above equipment, the inside of the air compression room 3 is decompressed. Some secrete which scattered [tear] by blasting of the compressed air to the cornea Ec examined the eyes tends to flow into the air compression room 3 from a nozzle 4 with the reduced pressure in this air compression room 3. In this way, the tear which flowed might adhere inside [which is located on the axis L of the nozzle 4 in the air compression room 3] the posterior part aperture 6, the permeability to the justification flux of light, a measuring beam bundle, etc. which pass the posterior part aperture 6 might be lowered, and trouble might be caused to measurement. Although the front face of hole aperture glass 5 is also stained with dirt, such as a tear, it is easy to make a judgment whether it should clean up by this being a place which is visible to a tester. A tester may not notice until the posterior part aperture 6 is in the interior of equipment to it, dirt is easy to be left since it is rare to touch a tester's eyes, and measuring [of an alignment error etc.] becomes unusual. Although the thing of an approach which is putting before a nozzle the lens cap to which the mirror's was attached as a means detecting the dirt of optical system, returns the flux of light from optical system in equipment, and detects dirt etc. is also known, inspecting dirt has the fault that it is troublesome and the mirror side of the removed lens cap must keep clean, while anchoring removal of a lens cap taking time and effort, and continuing measurement of long duration. This invention is to offer the non-contact type tonometer which can detect extent of the dirt of the optical element of an air compression room posterior part, without having been thought out in view of the above faults and troubling a tester's hand.
[0004]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, this invention has the following descriptions.
1) In the non-contact type tonometer on which a compression gas is sprayed to optometry-ed through a nozzle from the compression space which compresses the gas in a cylinder with a piston and is open for free passage in

said cylinder The optical element of the translucency prepared in said compression space in order to penetrate the flux of light for the justification which progresses along the direction of an axis of said nozzle, A floodlighting means to floodlight the flux of light towards this optical element, and a quantity of light detection means to detect the quantity of light level of the flux of light of said floodlighting means which penetrated said optical element, It has a comparison means [predetermined quantity of light level / level / which was detected by this quantity of light detection means / quantity of light], and is characterized by making the dirt of said optical element detectable.

0005] (2) Either the floodlighting means of (1) or a quantity of light detection means is characterized by laying underground in the above-mentioned cylinder or compression space.

0006] (3) Quantity of light detection of the quantity of light detection means of (1) is non-contact type tonometer characterized by carrying out whenever it sprays a compression gas to optometry-ed and a piston returns to a criteria location.

0007] (4) Predetermined quantity of light level compared with the comparison means of (1) is characterized by to establish the warning means which emits warning, when it is below the predetermined quantity of light level to which it was set based on the quantity of light required for measurement of the flux of lights, such as the justification flux of light which penetrates said optical element, and the quantity of light level further detected by said quantity of light detection means was set.

0008]

Example] Hereafter, the example of this invention is explained based on a drawing. Drawing 1 is a side sectional view near the air compression room of this example. In addition, the same sign is given to the almost same member as the member of above-mentioned drawing 4 , and the explanation is omitted. The lens is attached at the tip, and 11 is a powerful directive infrared emitting diode, and it is laid under the cylinder 1 so that the axis L of a nozzle 4 may turn and carry out light transmission of the flux of light to the neighborhood at which the posterior part aperture 6 is crossed. 12 is a photo detector for quantity of light detection, and is arranged on the floodlighting shaft M of the light emitting diode 11 which passes the posterior part aperture 6. Since it concentrates on the range which ****ed in the bore of a nozzle 4 focusing on Axis L and the tear which flows from a nozzle 4 adheres to the posterior part aperture 6, a photo detector 12 is arranged in the location which receives the transmitted light flux of the range at least. In addition, the location of an infrared emitting diode 11 and a photo detector 12 may be made reverse, and may be arranged. Whenever ophathalmotonometry is completed and a piston 2 returns to an initial valve position, an infrared emitting diode 11 and a photo detector 12 operate, and the dirt of the posterior part aperture 6 is detected automatically.

0009] Drawing 2 is the control-system block diagram of quantity of light detection. 21 is a detector which processes the quantity of light signal acquired by the photo detector 12, and 22 is a microcomputer which controls this whole equipment. 23 is a drop which displays warning of a purport [need / the posterior part aperture 6 / to be cleaned]. The quantity of light signal from a photo detector 12 is inputted into a microcomputer 22 through a detector 21. Drawing 3 is drawing having shown the output wave of the quantity of light obtained by the photo detector 12, a is in the condition that the posterior part aperture 6 is not dirty, and the quantity of light level is I1. It has become. quantity of light level I2 which b is in the condition to which the output of a photo detector 12 fell with the dirt of the posterior part aperture 6, and serves as a measurement error of the optical-system group 7 up to -- it is falling. The quantity of light level of an output wave obtained from a photo detector 12, and I1 I2 Extent of the dirt of the posterior part aperture 6 can be known by comparing. It is I2 here. Before falling to quantity of light level, the quantity of light level I0 used as the criterion for telling a tester about the stage of cleaning of the posterior part aperture 6 is set up, and the microcomputer 22 is made to memorize. A microcomputer 22 is the quantity of light level from a photo detector 12, and I0. It compares and is I0. When judged with the following, a signal is sent to a drop 23, the posterior part aperture 6 is dirty and a drop 23 emits warning of a purport to be cleaned.

0010] Various changes are possible for the above example, for example, by adding the function which enables the attachment and detachment of the optical element part equivalent to the posterior part aperture 6 of the example of this invention which these people proposed in Japanese Patent Application No. No. (name of invention "the non-contact type tonometer") 128355 [five to] to compression space 3, the cleaning becomes easy and it can be used as much more advantageous equipment.

0011]

Effect of the Invention] According to this invention, the dirt of the optical element of an air compression room posterior part can be detected automatically, without troubling a tester's hand.

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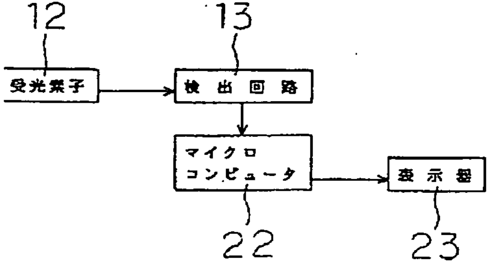
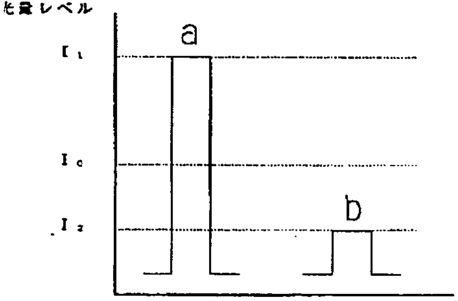
DRAWINGS

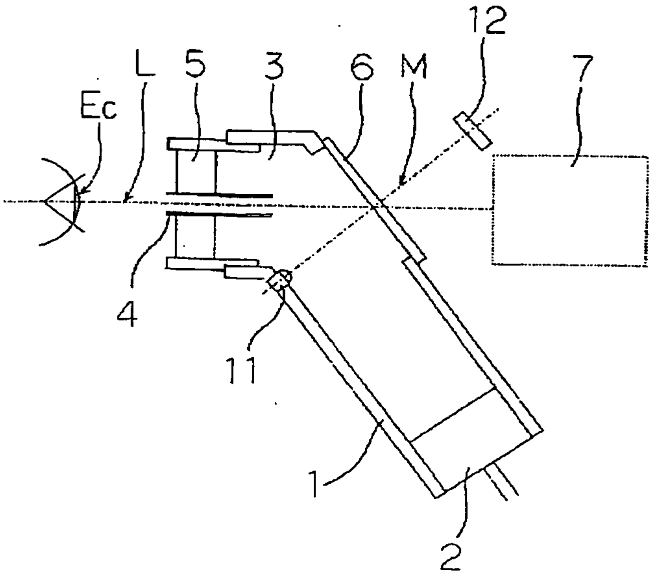
[Drawing 2]



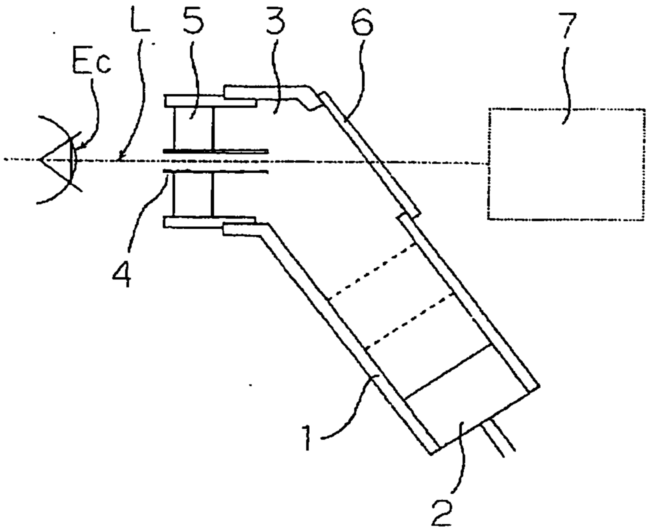
[Drawing 3]



[Drawing 1]



[Drawing 4]



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審査請求　未請求　請求項の数４　ＦＤ　（全４頁）

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(22)出願日　平成５年(1993)８月31日
(71)出願人　000135184
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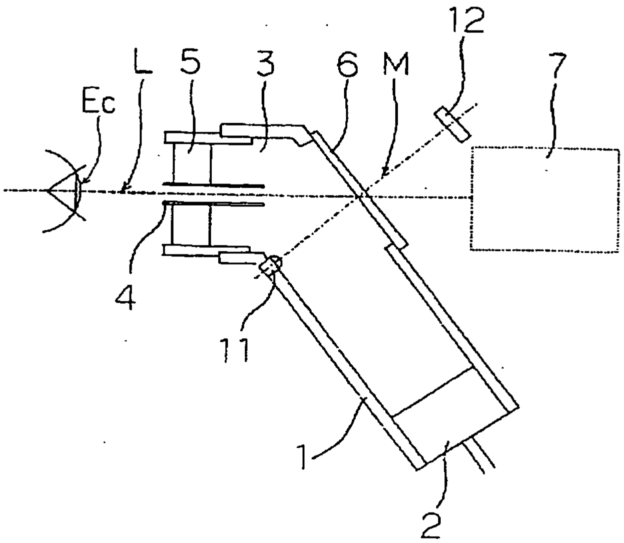
(54)【発明の名称】非接触式眼圧計

(57)【要約】
【目的】　検査者の手を煩わすことなく、空気圧縮室後部の光学要素の汚れを自動的に検出することができる装置を提供する。
【構成】　シリンダ内の気体をピストンにより圧縮し、前記シリンダに連通する圧縮室からノズルを通して被検眼に対して圧縮気体を吹き付ける非接触式眼圧計において、前記ノズルの軸線方向に沿って進む位置調整等のための光束を透過するために前記圧縮室に設けられた透光性の光学要素と、該光学要素に向けて光束を投光する投光手段と、前記光学要素を透過した前記投光手段の光束の光量レベルを検出する光量検出手段と、該光量検出手段により検出された光量レベルを所定の光量レベルと比較する比較手段とを有し、前記光学要素の汚れを検知可能としたことを特徴とする。



【特許請求の範囲】

【請求項１】　シリンダ内の気体をピストンにより圧縮し、前記シリンダに連通する圧縮室からノズルを通して被検眼に対して圧縮気体を吹き付ける非接触式眼圧計において、前記ノズルの軸線方向に沿って進む位置調整等のための光束を透過するために前記圧縮室に設けられた透光性の光学要素と、該光学要素に向けて光束を投光する投光手段と、前記光学要素を透過した前記投光手段の光束の光量レベルを検出する光量検出手段と、該光量検出手段により検出された光量レベルを所定の光量レベルと比較する比較手段とを有し、前記光学要素の汚れを検知可能としたことを特徴とする非接触式眼圧計。

【請求項２】　請求項１の投光手段または光量検出手段のどちらかは、上記シリンダ内あるいは圧縮室内に埋設することを特徴とする非接触式眼圧計。

【請求項３】　請求項１の光量検出手段の光量検出は、被検眼に対して圧縮気体を吹き付けてピストンが基準位置に復帰する度に行うことを特徴とする非接触式眼圧計。

【請求項４】　請求項１の比較手段で比較される所定の光量レベルは、前記光学要素を透過する位置調整光束等の光束の測定に必要な光量に基づいて設定され、さらに前記光量検出手段により検出された光量レベルが設定された所定の光量レベル以下の場合に警告を発する警告手段を設けたことを特徴とする請求項１の非接触式眼圧計。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、被検眼に圧縮気体を吹き付けて角膜を変形し、その変形状態を検出することにより被検眼の眼圧を測定する非接触式眼圧計に関する。

【０００２】

【従来の技術】この種の非接触式眼圧計の圧縮気体を噴射する機構としては、図４に示すような機構が知られている。シリンダ１内のピストン２は、測定開始とともに、不図示の駆動機構により上に押し上げられる。シリンダ１に連通する空気圧縮室３は、ノズル４を保持する孔開きガラス５と透明板から成る後部窓６等によりその側壁が構成されている。後部窓６はノズル４の軸線Ｌ上にあり、後部窓６の背後には観察光学系、位置調整光学系、固視光学系、測定光学系等の光学系群７が配置され、その各光束は後部窓６を通過する。測定が開始されると、ピストン２はシリンダ１内で点線で示される位置まで移動し、これによってシリンダ１内の空気は空気圧縮室３で圧縮され、ノズル４から被検眼角膜Ｅｃへ吹き付けられる。空気噴射後、ピストン２は初期位置に戻り、この時ノズル４からは次の測定のための空気が吸い込まれる。

【０００３】

【発明が解決しようとする課題】上記の装置においてピストン２が初期位置に戻る時、空気圧縮室３内は減圧される。この空気圧縮室３内の減圧にともない、被検眼角膜Ｅｃへの圧縮空気の吹き付けにより涙等の飛散った分泌物の一部が、ノズル４から空気圧縮室３に流入しやすい。こうして流入した涙等は空気圧縮室３内のノズル４の軸線Ｌ上に位置する後部窓６の内側に付着し、後部窓６を通過する位置調整光束、測定光束等に対する透過率を下げ、測定に支障をきたすことがあった。孔開きガラス５前面にも涙等の汚れは付くが、ここは検査者に見える所であり掃除をすべきかどうかの判断はしやすい。それに対し後部窓６は装置の内部にあり、検査者の目に触れることが少ないので汚れは放置されやすく、アライメントエラー等の測定異常となるまで検査者は気が付かないこともある。光学系の汚れを検知する手段としては、ミラーの付いたレンズキャップをノズルの前にかぶせることで、光学系からの光束を装置内に戻し、汚れ等を検出する方法のものも知られているが、レンズキャップの取付け取外しに手間が掛かり、長時間の測定を続ける途中で汚れの検査をすることは煩わしく、また、外してあるレンズキャップのミラー面を清潔に保たなければならないという欠点がある。本発明は、上記のような欠点に鑑み案出されたもので、検査者の手を煩わすことなく、空気圧縮室後部の光学要素の汚れの程度を検出することができる非接触式眼圧計を提供することにある。

【０００４】

【課題を解決するための手段】上記課題を解決するために、本発明は以下のような特徴を有する。

（１）　シリンダ内の気体をピストンにより圧縮し、前記シリンダに連通する圧縮室からノズルを通して被検眼に対して圧縮気体を吹き付ける非接触式眼圧計において、前記ノズルの軸線方向に沿って進む位置調整等のための光束を透過するために前記圧縮室に設けられた透光性の光学要素と、該光学要素に向けて光束を投光する投光手段と、前記光学要素を透過した前記投光手段の光束の光量レベルを検出する光量検出手段と、該光量検出手段により検出された光量レベルを所定の光量レベルと比較する比較手段とを有し、前記光学要素の汚れを検知可能としたことを特徴とする。

【０００５】（２）　（１）の投光手段または光量検出手段のどちらかは、上記シリンダ内あるいは圧縮室内に埋設することを特徴とする。

【０００６】（３）　（１）の光量検出手段の光量検出は、被検眼に対して圧縮気体を吹き付けてピストンが基準位置に復帰する度に行うことを特徴とする非接触式眼圧計。

【０００７】（４）　（１）の比較手段で比較される所定の光量レベルは、前記光学要素を透過する位置調整光束等の光束の測定に必要な光量に基づいて設定され、さらに前記光量検出手段により検出された光量レベルが設定された所定の光量レベル以下の場合に警告を発する警

告手段を設けたことを特徴とする。

【０００８】

【実施例】以下、本発明の実施例を図面に基づいて説明する。図１は本実施例の空気圧縮室付近の側方断面図である。なお、前述の図４の部材とほぼ同一の部材には同一の符号を付しその説明は省略する。１１は、レンズが先端に付いていて指向性の強い赤外発光ダイオードであり、ノズル４の軸線Ｌが後部窓６と交わる付近にその光束を向けて透光するようにシリンダ１に埋設されている。１２は光量検知のための受光素子であり、後部窓６を通過する発光ダイオード１１の投光軸Ｍ上に配置されている。ノズル４から流入する涙等は、軸線Ｌを中心としてノズル４の内径に相応した範囲に集中して後部窓６に付着するため、少なくともその範囲の透過光束を受光する位置に受光素子１２は配置される。なお、赤外発光ダイオード１１と受光素子１２の位置は逆にして配置しても良い。眼圧測定が終了してピストン２が初期位置に戻る度に、赤外発光ダイオード１１及び受光素子１２が作動して後部窓６の汚れの検出を自動的に行う。

【０００９】図２は光量検知の制御系ブロック図である。２１は、受光素子１２で得られた光量信号を処理する検出回路であり、２２は本装置全体を制御するマイクロコンピュータである。２３は、後部窓６の清掃が必要である旨の警告を表示する表示器である。受光素子１２からの光量信号は、検出回路２１を経てマイクロコンピュータ２２へ入力される。図３は受光素子１２で得られた光量の出力波形を示した図であり、ａは後部窓６が汚れていない状態で、その光量レベルはＩ１　となっている。ｂは後部窓６の汚れにより受光素子１２の出力が低下した状態で、光学系群７の測定エラーとなる光量レベルＩ２　まで低下している。受光素子１２から得られる出力波形の光量レベルと、Ｉ１　、Ｉ２　とを比較することにより後部窓６の汚れの程度を知ることができる。ここでＩ２　の光量レベルに低下する前に、後部窓６の清掃の時期を検査者に知らせるための判定基準となる光量レベルＩ０を設定し、マイクロコンピュータ２２に記憶させておく。マイクロコンピュータ２２は受光素子１２からの光量レベルとＩ０　とを比較し、Ｉ０　以下と判定された場合は表示器２３に信号が送られ、表示器２３は後部窓６が汚れており清掃が必要である旨の警告を発する。

【００１０】以上の実施例は種々の変容が可能であり、例えば本出願人が特願平５－１２８３５５号（発明の名称「非接触式眼圧計」）において提案した、本発明の実施例の後部窓６に相当する光学要素部分を圧縮室３に着脱自在にする機能を付加することにより、その清掃が容易になり一層有利な装置とすることができる。

【００１１】

【発明の効果】本発明によれば、検査者の手を煩わすことなく、空気圧縮室後部の光学要素の汚れを自動的に検出することができる。

【図面の簡単な説明】

【図１】本実施例の空気圧縮室付近の側方断面図である。

【図２】本実施例の光量検知の制御系ブロック図である。

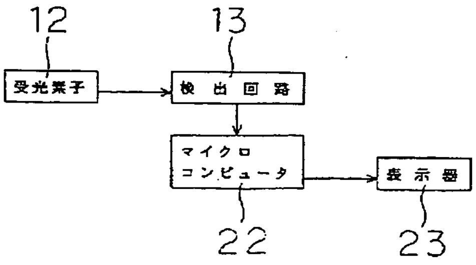
【図３】受光素子１２で得られた光量の出力波形を示した図である。

【図４】従来の装置の空気圧縮室付近の側方断面図である。

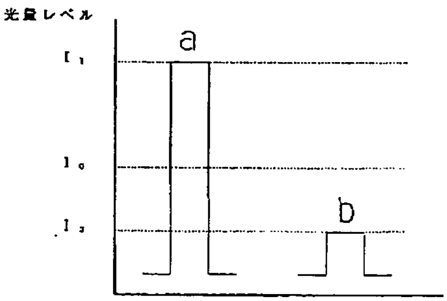
【符号の説明】

１	シリンダ
２	ピストン
３	空気圧縮室
４	ノズル
５	孔開きガラス
６	後部窓
７	光学系群
１１	赤外発光ダイオード
１２	受光素子

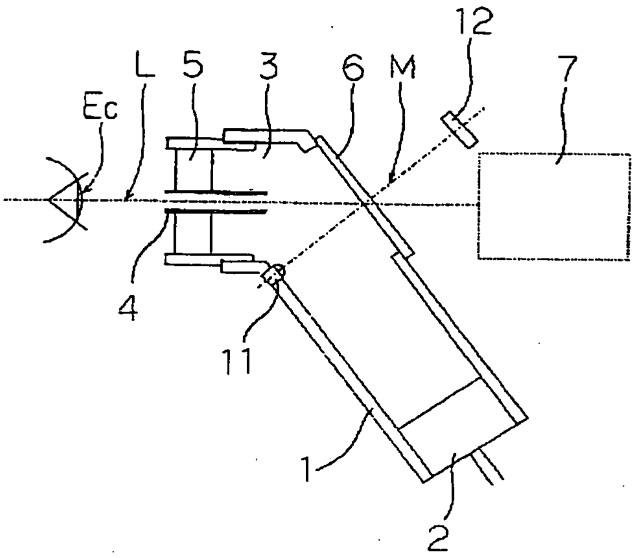
【図２】



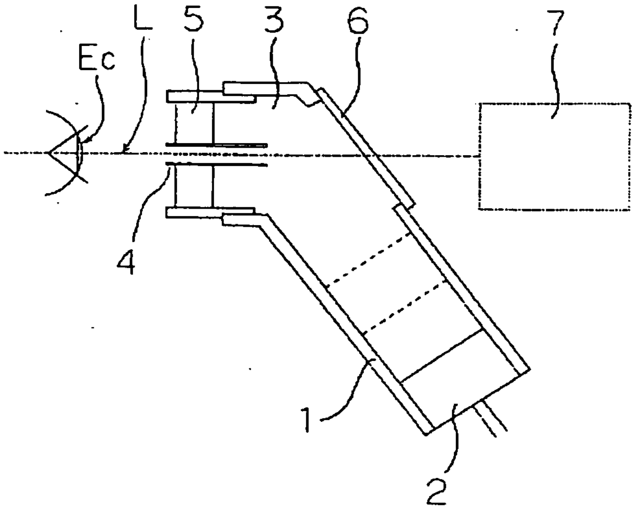
【図３】



【図1】



【図4】



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